



BIOLOGY EDUCATION: ACTIVE LEARNING EXERCISES TO ENGAGE HIGH SCHOOL AND COLLEGE STUDENTS

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ABSTRACT

I taught students both at High School and College level which were actively engaged in classroom and laboratory. These active learning exercises improved students' remembrance, comprehension, understanding, analytics and creativity.

INTRODUCTION:

This article includes a table and diagrammatic representation explaining active learning exercises employed in large & small lecture & classroom and biology laboratory.

High School students of IGCSE were taught below topics using active learning exercises as detailed in table employing educational tools: PowerPoint presentation and Pointer, Marker and White Board, Scanner and Textbook, Smart Board and Digital Marker.

Topic	Active Learning Exercise
General Biology	<ul style="list-style-type: none"> Students observed the images shown on Smart Board to identify living and non-living things. Students were shown images of evolutionary tree to identify common ancestors Students participated in an online dichotomous key. Students observed specimens in biology laboratory and classified them into phylum and kingdom.
Cell Biology	<ul style="list-style-type: none"> Students were shown micrographs of cell types taken under different microscopes and then were asked to compare differences. Students visited laboratory to draw biological diagrams of bacteria, protozoa and fungi. Students observed permanent mount of animal and plant cells. Students prepared and observed temporary mount of animal and plant cells. Students visited laboratory to observe process of diffusion: dissolution particles of colour in liquid: moving from centre bottom of beaker to other parts of beaker) to & movement of scent gases from one par and endosmosis in potatoes. Students were shown micrographs of cell organelles to understand structure of organelles. Students were shown mitosis and meiosis slides and were challenged to identify the stage of cell cycle. Students given a laboratory exercise to calculate magnification of cells observed.
Biological Chemistry	<ul style="list-style-type: none"> Students observed, measured and recorded the chemical test used to identify presence of fats, carbohydrates and proteins. Students were shown images of substrate and enzymes to determine the outcome of enzymatic reaction. Students were challenged to identify rate of reaction as shown on graphs affected by pH, temperature, substrate and enzyme. Students calculated the balanced diet and energy required based on gender, weight and height using an online calculator. This activity helped students to understand importance of balanced diet in everyday life. Students were challenged with multiple choice questions.
Plant Biology	<ul style="list-style-type: none"> Outreach Field Activity: Many leaves were observed by students in the field to measure and recorded the structure of leaf and with further discussion in classroom why leaves present on plants vary in number of veins.
Genetics and Bio-mathematics	<ul style="list-style-type: none"> Students in a team based learning exercise explained menstrual cycle. Students presented oral presentation on Twins and Sexually transmitted diseases. Students used a text book example to understand inheritance and variation in plants. Students were challenged with problem solving questions on genetic crosses, dominance, incomplete dominance and co-dominance by showing images to compare the genotype and phenotype of plants and animals.
Biotechnology	<ul style="list-style-type: none"> Students were given a wet lab TASK to clone a gene in a plasmid using smart board which codes for a protein, enzyme and drugs important for biotechnology industry.

Homeostasis and Nervous System	<ul style="list-style-type: none"> Students were shown images to identify homeostasis and elaborate how homeostasis helps in control of body temperature in real life. Students explained how information flows in a reflex arc: Receptor, Sensory Neuron, Interneuron, Motor Neuron and Effector cell by a Role Play.
Ecology	<ul style="list-style-type: none"> Students in group compared differences in food webs, food chain, pyramid of biomass, number and mass to identify differences and how flow of energy at each trophic level is altered when an organism at each level declines in number. Individual presentation by students on biogeochemical cycles.
Bio-language	<ul style="list-style-type: none"> Students explained structure of plant with help of white board and marker in French and Spanish language.

College students at St Theresa International College of 501 105, 900 101, 153 111 and 153 112 courses were taught the following topics using Marker and White Board and Pointer and PowerPoint presentation:

1. Principles of Biology, Structure and function of Cell, Cellular reproduction and genetic structure and physiology of animals.
2. Study of the practical aspects of biology frequently used in medicine and environment using principles and concepts of biology; biological structures of plants and animals which include divisions, syntheses and functions of cells.
3. Basic biology of animals; structure and working processes for survival of animals ranging from molecular level, living cells, tissues, organs system up to life and structure level, and functions of nucleic acid in the genetic inheritance.

College students were given below tasks to actively engage students in class-room.

